

A new species of the genus *Cybaeus* (Arachnida: Araneae: Cybaeidae) from Korea

Byung-Woo Kim¹ and Joo-Pil Kim²

¹ Department of Life Science, College of Natural Sciences, Hanyang University, Seoul 133–791, Korea

² Department of Life Science, College of Natural Sciences, Dongguk University, Seoul 100–715, Korea

E-mail: bwkim00@hotmail.com

Abstract — A new species of *Cybaeus* spiders collected from Mt. Odaesan, *C. aratrum* sp. nov., is described with detailed illustrations, leg spination, trichobothrium patterns and SEM photographs. This species can be distinguished from other *Cybaeus* species by male palpal conductor largely developed plow-like with twisted distal part, embolar tip injector-like, and patellar apophysis with 44 protuberances on the distal part. A key to the species of Korean cybaeid spiders is provided.

Key words — taxonomy, morphology, Cybaeidae, *Cybaeus*, Korea

Introduction

The family Cybaeidae is epigeal, a group of the most common spider taxa in woodlands and a fairly small family elevated by Forster (1970) containing at least 157 species in 12 genera (Platnick 2007). Of these, the genus *Cybaeus* is the largest (93 species) in this family Cybaeidae and is known to have the highest species diversity in Japanese spider fauna (Japan, 51 species; USA, 28; China, 6; Korea, 3 etc.). These spiders are commonly found in soil litter, under stones or logs on the forest and some caves (ex. eyeless *C. itsukiensis* in limestone caves in Kumamoto Prefecture, Japan) in the Holarctic regions (Kobayashi 2006, Irie 1998). Recently, Ihara (1993, 1994, 2003a, b, 2005) provided many contribution on the morphology, variation of body length, geographic differentiations or distribution of the Japanese *Cybaeus* spiders. Also, Bennett (2005, 2006) has used three ontogenetic stages of female spermathecal duct to resolve the taxonomic problems of genus *Cybaeus* spiders and revised many Holarctic species for the synonymic changes and new species.

Although Namkung (2001, 2003) presented simple illustrations of three Korean *Cybaeus* species (*C. mosanensis* Paik & Namkung, 1967; *C. longus* Paik, 1966; *C. triangulus* Paik, 1966), these species cannot be reliably identified from his pictorial book. The Korean *C. mosanensis* appears to have two types in body size and geographic differences (Paik 1966) and male palp of *C. longus* firstly reported by Namkung (2001) is in fact *C. triangulus* in prolateral view of male palp (Paik 1966, 1978).

During a survey of the spider fauna of Korea from 2004 to 2007, spiders of the genus *Cybaeus* were collected from pitfall traps in natural forests. In this paper, *Cybaeus aratrum* sp. nov. is described on the basis of the characters

(ex. spination, trichobothrium pattern etc.) of male palpal organs. The main goal of this paper is to provide research data for the future revisional study of the Korean cybaeid spiders.

Materials and methods

Specimens were collected beside small streams in vegetation characterized by a mix of dead trees, giant fir trees (*Abeies holophylla* Maxim.), and a broadleaf species (*Quercus mongolica* Fischer), in the Korean National Park of Mt. Odaesan (KNPO), Gangwon-do. At each station, twenty pitfall traps (plastic cups, height 6.3 cm, diameter 8 cm) were set 10 m apart in two rows and filled with ethylene glycol (Greenslade & Greenslade 1971). Specimens were preserved with 70% ethanol. Measurements are in millimeters unless noted otherwise. Specimens examined in this paper will be deposited in the National Institute of Biological Resources (NIBR) and the Laboratory of Biodiversity, Hanyang University (LBHU).

The descriptive terminology and the format of spination of legs follow those of Kim and Lee (2006, 2007). Abbreviations used: ap, apical; AER, anterior eye row; ALE, anterior lateral eye; AME, anterior median eye; CF, cymbial furrow; CFR, cymbial furrow rate, longest cymbial furrow/cymbium length x 100; CO, conductor; Cy, cybium; d, dorsal; EM, embolus; Eye ratio, longest eye row/carapace width x 100; P, posterior; Pa, patella; PA, patellar apophysis; PER, posterior eye row; PLE, posterior lateral eye; PME, posterior median eye; r, retrolateral; RTA, retrolateral tibial apophysis; SD, sperm duct; ST, subtegulum; STR, sclerotized tegular ridge; Ti, tibia; TM, tegulum; TS, tegular sclerite.

Systematic accounts

Order Araneae Clerck, 1757

Family Cybaeidae Banks, 1892

Genus *Cybaeus* L. Koch, 1868

Cybaeus aratrum sp. nov.

(Figures 1–15)

Type materials. Holotype, male, Temple Woljeongsan, Mt. Odaesan, Gangwon-do, 29 June 1997, B. W. Kim, GPS: N 37°43'48", E 128°35'43", 662 m a.s.l. (NIBR). Paratypes, 1 male, 1 subadult female, 3 juveniles, Temple Woljeongsan, Mt. Odaesan, Gangwon-do, 29 June, 1997, B. W. Kim, 1 male, Eulsudong village, 24 July 2007, B. W. Kim, (LBHU).

These specimens were found wandering on the ground among stones and leaf litter.

Dimensions (mm). Male: Body length 9.7; carapace length 4.6, width 3.2, height 1.8; cheliceral length 2.2, width 0.9; cheliceral fang length 1.4; endite length 1.3, width 0.8; labium length 0.7, width 0.7; sternum length 1.2, width 1.1; clypeus height 0.3; AER 1.1, PER 1.3, AME 0.2, ALE 0.3, PME 0.2, PLE 0.1. Eye formula ALE > PME = AME > PLE. Palp 6.0 (2.2, 0.8, 0.7, 2.3). First leg 19.8 (5.0, 1.6, 5.5, 5.5, 2.2), second leg 17.8 (4.7, 1.6, 4.6, 4.7, 2.2), third leg 13.6 (3.5, 1.3, 3.1, 3.9, 1.8), fourth leg 16.5 (4.1, 1.3, 3.8, 5.0, 2.3). Leg formula I II IV III. Abdomen length 4.4, width 3.1, height 2.9.

Description. *Holotype, male*: Medium-sized spider. Carapace elongate, 1.4 times as long as wide, moderately narrowed in eye area, with distinctly longitudinal fovea at middle (Figure 1). AER straight, PER slightly procurved in frontal view; PME smaller than other eyes, AME separated by slightly wider than their diameter, eye ratio 41 (Figure 2). Clypeal height 1.5 times as long as AME diameter, with pair of eyebrow-shaped chila (Figure 2). Chelicerae with numerous long setae, lateral condyle yellowish brown, with 3 promarginal teeth, middle one largest; retromargin with 3 teeth and 6 fine apophyses (Figure 3). Endites reddish brown, widest at mid part; labium rectangular, 1.6 times as long as wide (Figure 4). Sternum shield-shaped, widest at second coxae, not protruding between fourth coxae (Figure 5).

Palp (Figures 6–9) without claw; tibia with 10 trichobothria in 2 rows (6d–4d), tarsus with 5 in 1 row (5d); femur with 3 spines (1–1–1 on dorsal), tibia with 2 (0–1–0 on dorsal and prolateral), tarsus with 10 (1–0–1 on dorsal; 1–1–2 on prolateral; 0–0–2 on ventral; 0–1–1 on retrolateral). Legs yellowish brown; length of patella I + tibia I always longer than carapace length; trochanters not notched; tibia with 14–17 trichobothria in 4 rows (2p–3d–5d–4r on leg I, 4p–4d–4d–4r on II, 3p–5d–5d–4r on III, 3p–4d–5d–4r on IV), metatarsus with 7 to 8 in 1 row (7 on leg I, II and III, 8 on IV), tarsus with 9 in 1 row; tarsal organ situated close to distal end of tarsus, slightly anterior of distal trichobothrium; tarsus with

3 claws, upper claws with 7 to 8 side teeth (7 on leg I, III and IV, 8 on II), lower with 3 to 4 (3 on leg I, II and III, 4 on IV). Leg spination: leg I femur with 8 spines (1–1–2 on dorsal; 0–1–2 on prolateral; 0–1–0 on retrolateral), tibia with 10 (1–1 on prolateral; 2–2–2–2ap on ventral), metatarsus with 9 (1–0–1 on prolateral and retrolateral; 2–2–1 on ventral;), tarsus without spine; leg II femur with 7 spines (1–0–1 on dorsal; 0–1–0–2 on prolateral; 0–1–0–1 on retrolateral), tibia with 10 (0–1–1–1 on prolateral; 2–2–2ap on ventral; 0–1–0 on retrolateral), metatarsus with 11 (1–1–1–1 on prolateral; 2–0–2–1 on ventral; 0–1–0–1 on retrolateral); leg III femur with 7 spines (1–1–1 on dorsal; 0–1–1 on prolateral; 0–1–1 on retrolateral), tibia with 10 (1–1 on prolateral; 2–2–2ap on ventral; 1–1 on retrolateral), metatarsus with 15 (1–2–0–2 on prolateral; 2–2–1 on ventral; 1–2–0–2 on retrolateral), tarsus with 2 (0–0–1 on ventral; 0–0–0–1 on retrolateral); leg IV femur with 6 spines (1–1–1 on dorsal; 0–1–1 on prolateral; 0–0–1 on retrolateral), tibia with 9 (1–1 on prolateral; 2–1–2ap on ventral; 1–1 on retrolateral), metatarsus with 14 (1–2–0–2 on prolateral; 2–2–1 on ventral; 1–1–1–1 on retrolateral), tarsus with 3 (0–0–2 on ventral; 0–0–0–1 on retrolateral). Abdomen ovoid, with irregular whitish spots and indistinct chevrons on the posterior part of dorsum (Figure 1). Cribellum absent.

Male palp (Figures 6–9): patellar apophysis developed with 44 spikes (tiny protuberances) on the dorsal part; RTA modified long, shallow; CFR, 17%, cymbial furrow (0.4 mm) one sixth as long as cymbial length (2.3 mm); tegular sclerite weakly sclerotized, longitudinally situated on the center of tegulum, and subtegulum present; two linear sclerotized tegular ridges rounded, situated on the lower base of embolus; conductor largely developed plow-like with twisted distal part, situated on the lateral inner margin; embolus expanded curvedly linear, wound clockwise direction (left palp), originating anteriorly, shorter than the cymbial width and with injector-shaped embolar tip situated in inner distal part; sperm duct distinctly appear on the lateral margin; median apophysis absent.

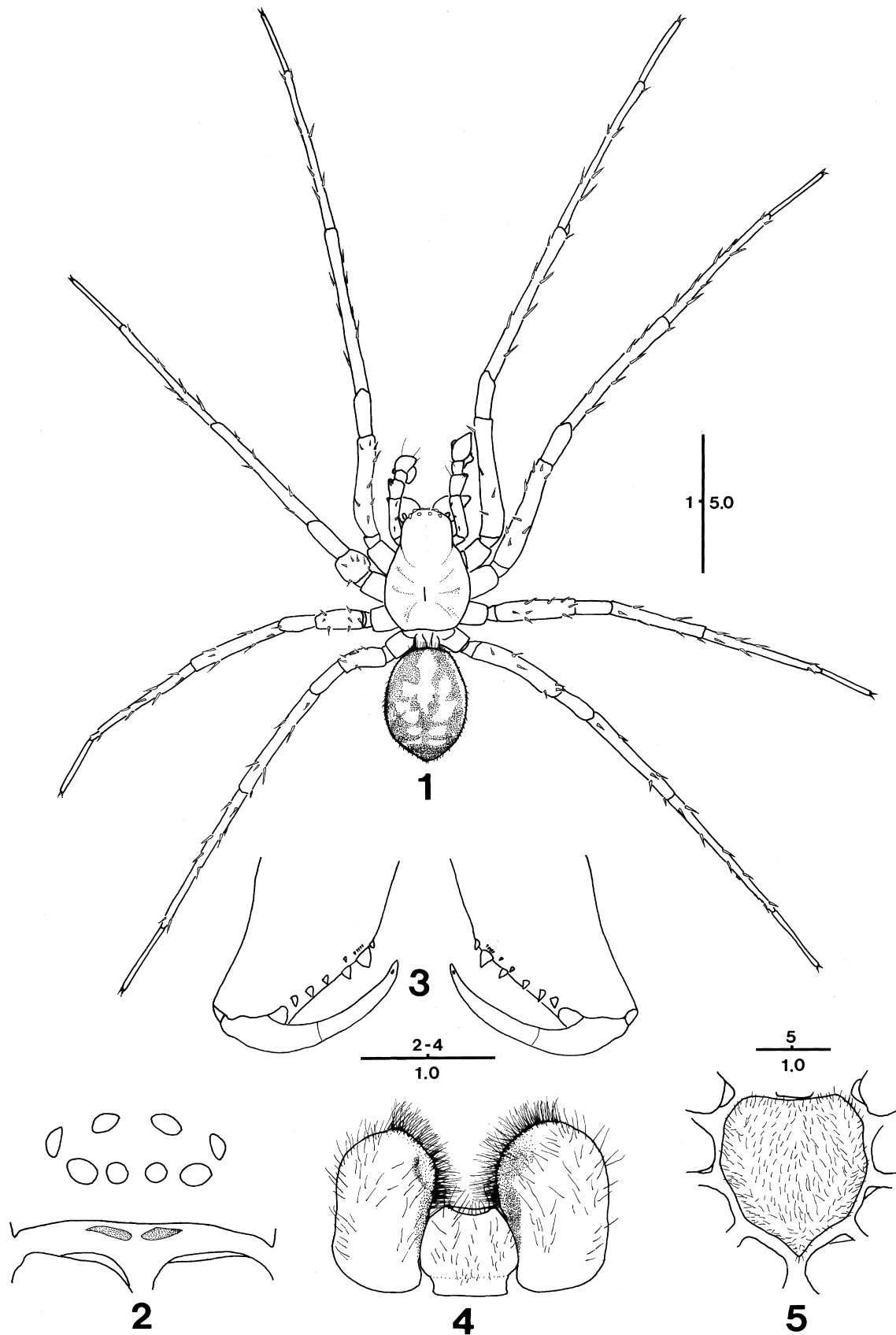
Distribution: Korea (Mt. Odaesan).

Etymology: The specific name is derived from the special plow-like (Latin, aratrum) conductor in male palpal organ.

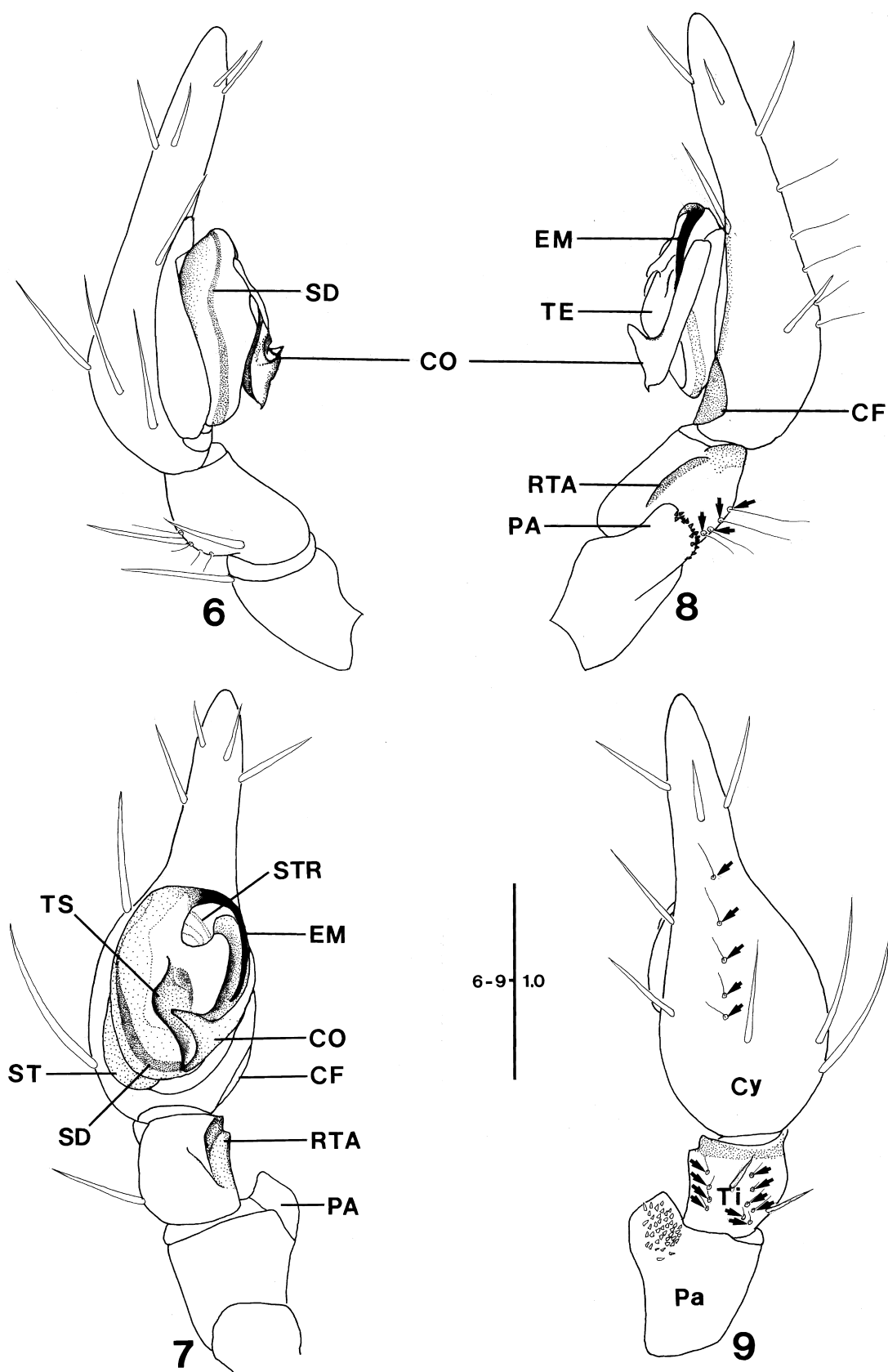
Remarks: The new species can be distinguished from other *Cybaeus* spiders by the male conductor largely developed plow-like with twisted distal part, embolar tip injector-like, 44 small spikes on the distal part of patellar apophysis and tegular sclerite longitudinally situated on the center of tegulum.

Key to the species of the cybaeid spiders from Korea

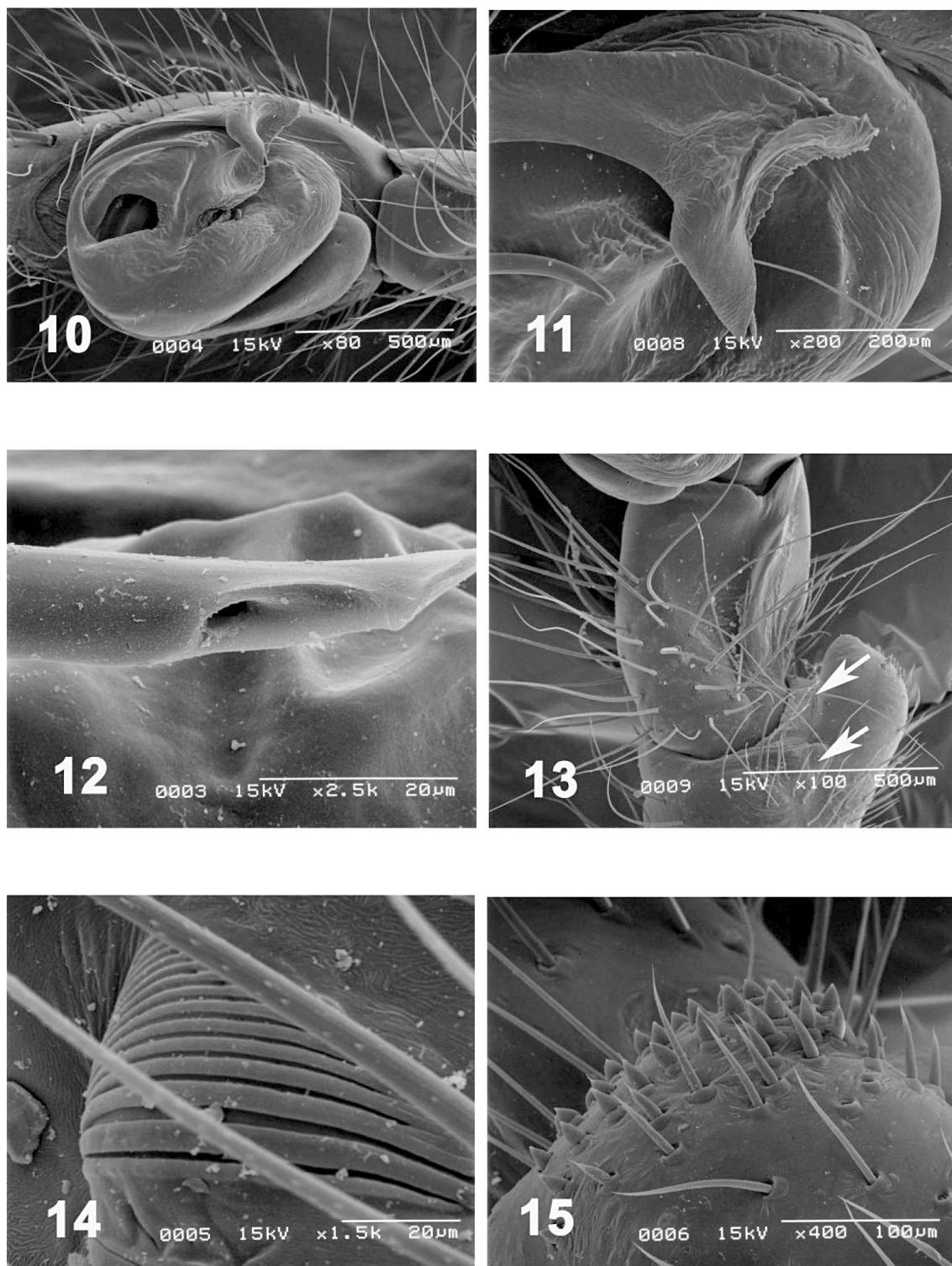
1. Patellar apophysis of male palp present 2
- Patellar apophysis of male palp absent *Argyroneta aquatica* (Clerck, 1757)
2. AME diameter large, more than one fifth clypeal height



Figs. 1-5. *Cybaeus aratrum* sp. nov. from Korea, holotype, male. 1. Habitus, dorsal view. 2. Eye area and clypeus, anterior view. 3. Chelicerae, posterior view. 4. Endites and labium, ventral view. 5. Sternum, ventral view.



Figs. 6-9. *Cybaeus aratrum* sp. nov. from Korea, holotype, male. 6-9. Male palpal organs and trichobothria (arrows), left part, prolateral view (6), ventral view (7), retrolateral view (8), dorsal view (9). Abbreviations: CF, cymbial furrow; CO, conductor; Cy, cybium; EM, embolus; Pa, patella; PA, patellar apophysis; RTA, retrolateral tibial apophysis; SD, sperm duct; ST, subtegulum; STR, sclerotized tegular ridge; TE, tegulum; TS, tegular sclerite.



Figs. 10–15. SEM photographs of *Cybaeus aratrum* sp. nov. from Korea, paratype, male. 10–15. Male palp, left part, ventral view (10), conductor (11), embolar tip (12), tibia covered with long hairs and patellar apophysis with slit sense organs arrowed (13), lyriform organ (14) and tiny protuberances (15) on patellar apophysis.

..... 3
—AME diameter small, as long as one tenth clypeal height
Dolichocybaeus whanseunensis (Paik & Namkung, 1967)
3. Epigynum with triangular or rectangular atrium and

without semicircle depression 4
—Epigynum with oval atrium and semicircle depression on
the upper part of atrium *Cybaeus longus* Paik, 1966
4. Embolus longer than cymbial width and patellar

- apophysis with tiny protuberance 5
 — Embolus shorter than cymbial width and patellar
 apophysis without tiny protuberance
 *Cybaeus triangulus* Paik, 1966
 5. Conductor linearly expanded, with sharply curved distal
 part *Cybaeus mosanensis* Paik & Namkung, 1967
 — Conductor broadly expanded, with largely plow-like dis-
 tal part *Cybaeus aratrum* sp. nov.

Acknowledgments

The authors wish to express their sincere thanks to Mr. J. Namkung, Prof. W. Lee of Hanyang University, Dr. X. Xu of Chinese Academy of Sciences, Dr. H. Ono of the National Science Museum of Japan, Dr. Y.M. Marusik of the Russian Academy of Sciences and Dr. R.G. Bennett of the British Columbia Ministry of Forest of Canada for many valuable comments and providing several important papers. This research was supported financially by the Korea Research Foundation Grant (KRF-2006-005-J01901). This study was partially supported by Korea Forest Research Institute (KFRI). Some results were obtained as results of KFRI preject "Development of Forest Eco-Map of Korea".

Literature Cited

- Bennett, R. G. 2005. Cybaeidae. pp. 85–90. In: Ubick, D., Paquin, P., Cushing, P. E. & Roth, V. (Eds), Spiders of North America: an identification manual. American Arachnological Society.
- Bennett, R. G. 2006. Ontogeny, variation and synonymy in North American *Cybaeus* spiders (Araneae: Cybaeidae). Can. Entomol., 138: 473–492.
- Forster, R. R. 1970. The spiders of New Zealand. Part III. Otago Mus. Bull., 3: 1–184.
- Greenslande, P. & Greenslande, P. J. M. 1971. The use of baits and preservatives in pitfall traps. J. Aust. Entom. Soc., 10: 253–260.
- Ihara, Y. 1993. Five new small-sized species of the genus *Cybaeus* (Araneae: Cybaeidae) from the Chugoku District, Honshu, Japan. Acta Arachnol., 42: 115–127.
- Ihara, Y. 1994. Two new species of the genus *Cybaeus* (Araneae: Cybaeidae) from the Chugoku district, Honshu Japan. Acta Arachnol., 43: 87–93.
- Ihara, Y. 2003a. *Cybaeus akiensis* n. sp. (Araneae: Cybaeidae) from western Honshu, Japan, with some notes on its biology. Acta Arachnol., 52: 51–57.
- Ihara, Y. 2003b. Geographic differentiation of the *miyosii*-group of *Cybaeus* (Araneae: Cybaeidae) in western Japan, with descriptions of two new species. Acta Arachnol., 52: 103–112.
- Ihara, Y. 2005. *Cybaeus hatsushibai* n. sp. (Araneae: Cybaeidae) from Mt. Odaigahara, Honshu, Japan, with notes on geographical distribution and body size of its closely related species. Acta Arachnol., 54: 103–109.
- Irie, T. 1998. A new eyeless spider of the genus *Cybaeus* (Araneae: Cybaeidae) found in a limestone cave of Kyushu, Japan. Acta Arachnol., 47: 97–100.
- Kim, B. W. & Lee, W. 2006. Two poorly known species of the spider genus *Amban* (Arachnida: Araneae: Amaurobiidae) in Korea. J. Nat. Hist., 40: 1425–1442.
- Kim, B. W. & Lee, W. 2007. Spiders of the genus *Dracoanrius* (Araneae: Amaurobiidae) from Korea. J. Arachnol., 35: 113–128.
- Kobayashi, T. 2006. Ten new species of the genus *Cybaeus* (Araneae: Cybaeidae) from central Honshu, Japan. Acta Arachnol., 55: 29–44.
- Namkung, J. 2001. The spiders of Korea (1st edition). Kyo-Hak Publishing Co., Seoul, 648 pp.
- Namkung, J. 2003. The spiders of Korea (2nd edition). Kyo-Hak Publishing Co., Seoul, 648 pp.
- Paik, K. Y. 1966. Korean spiders of genus *Cybaeus* (Araneae, Argyronetidae). Kor. J. Zool., 9: 31–38.
- Paik, K. Y. 1978. Illustrated Flora and Fauna of Korea. Volume 21 (Araneae). Samwha Press, Seoul, 546 pp.
- Paik, K. Y. & Namkung, J. 1967. Korean spiders of genus *Cybaeus* (Araneae, Argyronetidae). Kor. J. Zool., 10: 21–26.
- Platnick, N. I. 2007. The world spider catalog, version 8.0 [online]. American Museum of Natural History. New York. Available from <http://research.amnh.org/entomology/spiders/catalog/index.html> (accessed 17 September 2007).

Received September 21, 2007 / Accepted January 18, 2008